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of
The Chartered Surveyors' Institution

SESSION 1937-1938.

AT THE ORDINARY GENERAL MEETING

Held at the Chartered Surveyors' Institution on Wednesday, 2nd March, 1938.

Mr. ROBERT COBB (President) in the Chair.

NEW MEMBERS.

The following new members were received by the PRESIDENT prior to the meeting and signed the Register:—

Professional Associates:

BRUNNING, GEORGE MORISON
COTTON, JOHN CAVE
HODGKINSON, BERNARD GILBERT WILLIAM
HUNT, JOHN DURWARD
JAMES, JAMES FREDERICK
LANGDON, AUGUSTUS JOHN
PINCHBECK, HAROLD WILLIAM

A DISCUSSION took place on Mr. G. LESLIE HEAD'S paper entitled

TOWN PLANNING IN LONDON.

Mr. E. B. GILLETT (Chartered Surveyor) said he felt honoured in having been asked to propose a vote of thanks to Mr. Head, although he felt incapable of doing it as it ought to be done and would have been done by Mr. Bedells who was to have undertaken the task, but who was unfortunately ill.

He would like to make a few general remarks and then touch on some of the details in Mr. Head's paper. There was a sufficient number of experts present to make it unnecessary for him, even if he could do so, to deal in any detail with the able, exhaustive and possibly controversial paper that Mr. Head had compiled for the edification and instruction of the members of the Institution.

Mr. Head's first, and perhaps his main, point concerned the effect of town planning on site values, and he would leave that question for others to deal with. He was sure Mr. Head would be the first to agree upon the urgency of the problem of town planning. It was a statutory duty imposed upon the town planning authorities, in the nature of a somewhat thankless task, and one in which, so far as possible, surveyors should give them their sympathetic assistance. He thought it would have been very much simpler for everyone concerned if the Poor Relief Act of 1601 could have been followed by a London Planning Act of 1632 instead of 1932, so that there would now be a lovely city to admire, and perhaps the members might have attended a debate that evening on the motion: "That in the opinion of this House "there is little to choose, as regards town planning, between Sir "Christopher Wren and Mr. Frank Hunt"!

It was the misfortune of surveyors that as a profession, with a few lucky exceptions in the case of those who acted for large estates, they generally acted for small owners, to whom details of site cover and user regulations were of vital importance. He thought that made surveyors occasionally lose sight of the larger conception of town planning to be applied to a city like London.

At the end of his paper Mr. Head said: "We Londoners are "justly proud of our great city," and he wondered whether Mr. Head meant the city as a whole. Personally he confessed that travel films, photographs and descriptions of foreign cities by those who had travelled abroad had made him wonder

whether architecturally Londoners had any right to be proud of their city in the mass. For example, last year he had received from his daughter in Milan a picture post-card of the new railway station which had been put up in that city. The Italian Government had thought that the station was unworthy of the town, so they had ordered a new one, and a magnificent one had been built which contrasted more than favourably with King's Cross or Liverpool Street! That was a simple matter when the methods of dictatorship could be applied to the acquisition of land, and perhaps the London County Council would promise similar results under similar conditions. If so, he suggested that on the whole it would be better to stick to Clapham Junction, and, if necessary, carry the war into the enemy's camp by endeavouring to contend that the only Michael Angelo worth knowing was the author of the Metropolitan Paving Act!

Turning now to a few points of detail in the paper, Mr. Head referred to the preamble of the Town and Country Planning Act of 1932. Some of the members might have noted that the preamble referred only to rural amenities, whereas Section 1 of the Act spoke of preserving and generally protecting the existing amenities, whether in urban or rural portions of the town planning area. It seemed as though the authors of the Act or those responsible for it did not think a great deal of the amenities of London. "Amenities" was defined in the dictionary as "pleasant ways." Mr. Head, he gathered, thought very little of London County Council amenities. He had hoped that the subject of roads, bridges and even tunnels might have been dealt with that evening by Sir Charles Bressey, who, in addressing a meeting not far from the Institution the previous night, had touched on the question of some of the new roads which this country was to have.

One point which was dealt with in the paper and which seemed rather important to him was that of dwelling-house density. When a deputation from the Institution met the London County Council Town Planning Committee last year, the deputation mentioned the case of an estate, typical of many in the south-eastern area of London, where the existing density (the estate was not a slum) was more than 40 to the acre, and asked whether, on redevelopment, that would have to be reduced to 12 to the acre. The answer was that while the standard density would be 12 to the acre that would not be inflexible, and the London County County would take the existing density into account and might grant a concession. A cynically minded member of the deputation then asked whether the concession would involve a *quid pro quo*, and the answer to that was that, if the proposal was to re-develop at a lower density than that which existed, that would in the

eyes of the town planning authority be in the nature of an improvement.

He would utter one word of warning to those who followed him in the discussion and who were prepared to have a rather greater tilt at Mr. Head than he had had. In fact, it would have been noticed that he had most carefully refrained from crossing swords with Mr. Head at all. The reason for that was that Mr. Head's paper was full of angles; in other words, he was definitely, in the parlance of to-day, compass-minded, and that gave the clue to one of his other activities, which was light and air. He had recently had to come up against Mr. Head on a light and air question in the West End of London, and he had stated his case as well as he could. At the end of it Mr. Head's remark was not exactly encouraging; he said: "I wish every case I had "to deal with was the same as yours; I should not lose one "moment's sleep over it!" There were a good many people concerned in the case and later on a conference was called, at which there were ten surveyors present, nine of them being on one side, and one, Mr. Head, on the other. It took the whole nine, acting jointly and in unison, to wring one small concession from Mr. Head, and Mr. Head described it as being, on the whole, a fair settlement! He would remind the meeting that one of the points on which Mr. Head had laid stress was flexibility!

He had great pleasure in proposing a vote of thanks to Mr. Head for his paper.

Mr. Holroyd F. Chambers (Chartered Surveyor), in seconding the motion, said that he had intended to speak on the paper, and when on the previous evening he had been asked whether he would second the vote of thanks he had said that he would do so with great pleasure.

Not only had he listened to Mr. Head's remarks that evening with very great interest but he had read the paper two or three times. It was one of the most carefully thought-out papers that the Institution had had before it for a long time, and he most heartily congratulated Mr. Head upon it. He felt himself to be definitely more competent to meet his friends the London County Council officials on town planning matters since he had read the paper. It was an admirable exposition of the appalling complexities of the draft scheme which had been promulgated by the Council and yielded to any careful reader a multitude of debating points with which to tease his opponents. From that point he regretted that Mr. Head's views and his own commenced to diverge. He used the word "opponents" advisedly, because, quite frankly, it was only in that relationship that he could feel that the paper was of any real utility, but he confessed that he

could not regard the town planning officials of the London County Council entirely in that relationship. He had been brought up in an atmosphere pregnant with the possibilities of enlightened town planning, and he could not help regarding those who were charged with working the Act in some measure as partners in arriving at a satisfactory solution of an extremely difficult problem. If they were failing (and he thought to a great extent they were failing) in achieving the ends in view, by all means let them be told so, but in that respect he must confess that he found the paper not only singularly unhelpful but positively harmful.

He most sincerely hoped that the discussion that evening would not be restricted entirely to the details of the draft scheme which was the subject of the present proposals. Quite frankly he felt that there existed a positive danger in devoted work to detail, such as the paper indicated, which tended to make confusion worse confounded for want of a wide perspective and imaginative foresight.

The foundation upon which Mr. Head erected the whole edifice of his paper was to be found in the following sentence in the paper: " Town planning, then, if it is to control development, must first have some development to control, and in order to have this it must observe, harness and make use of economic laws and not ignore them," and Mr. Head cited cases of legislation, not in the least parallel, which had had dire results through failure to observe those economic laws, or, he might say, to kow-tow to them. He would remind the members that the whole tariff policy of the country was based not on observing, harnessing and caressing economic laws on the one hand nor ignoring them on the other hand, but upon controlling economic laws to ends which would serve the community.

Mr. Head's economic law which had to be observed and harnessed was " the natural collective desire of the people each "—he would emphasise the word " each "—" to do what he thinks " will profit him the most." How many years back had Mr. Head taken them? Personally he would call it a law of human nature rather than an economic law, and nature in the rough rather than nature in the twentieth century. He knew of no economic law which required curbing and controlling more than that one did. It was that economic law, or law of nature as he preferred to call it, which ignored the good of the community for the selfish profit of the individual, which was the whole cause of the trouble in the matter. There might be some who disagreed with him in that, but he suggested that Mr. Head's paper, when reduced to essentials, was simply a defence of high land values, coupled with a plea for still higher land values. Mr. Head said: " A

"good town planning scheme should, therefore, be economic in "order to encourage development," and devoted several paragraphs of the paper to a discussion of what he meant by "economic," arriving at the conclusion that "conversely high "land values will tend to encourage re-development before the "existing buildings have reached an advanced stage of obsoles-"cence." It was a defence of high land values on the ground of good town planning.

Complaining of the low density of 12 houses to the acre, Mr. Head said: "Here we have an example of how a scheme may "defeat its own ends by creating slums instead of preventing them "—a result which might be avoided by appreciating the principle "that land, already made valuable by dense development, should "be scheduled in a manner which will make it still more valuable "if re-development is to be encouraged." He was not going to argue whether 8, 10, 20, 30 or 40 houses to the acre was reasonable; it would depend, amongst other things, on the character of the particular district which was being dealt with. What he was concerned to criticise was the principle which Mr. Head suggested should be the basis of town planning. To satisfy that principle, areas must be scheduled not even at their present density, whatever that might happen to be, but at a higher density in order to encourage development. He could see no valid reason whatever why a higher density should be permitted solely on the ground of an existing high land value. That meant either to increase by progressive means the existing density to an unknown limit or to force the population into flats and go on raising the land values, to the profit of the landowner and the disadvantage of the tenant, in accordance with Mr. Head's economic law. Yet Mr. Head said: "Town planning must pro-"duce the type of accommodation which the public demands, for "it should be the servant of the public and not its master." And that was to be achieved by the further raising of land values! Did Mr. Head mean what he said, or did he mean "the type of "accommodation which profits the landowner most?" They were not synonymous. High land values had not produced, he suggested, what the public wanted, for example, in the way of residential places in which to live. People were forced into flats which they did not want. If the members did not believe him, they should listen to what the London County Council and Borough Council tenants of the flats said about them, and they should listen to the evidence given by the existing tenants of cottages scheduled for demolition. However correct that scheduling might be on sanitary grounds, the tenants were unanimous in not desiring to leave those cottages and to reside in flats.

What a pass had already been reached by this uncontrolled

economic law, when a subsidy had to be provided to enable the greater part of the population to be housed at all! And not only a subsidy but a progressive subsidy, in accordance with the value of the land! Could anything be more foolish than to house the population on expensive sites in the middle of towns, where the land, if worth the high prices asked for, must be in demand for other more appropriate purposes? Yet that was the policy to which Mr. Head asked the members to subscribe. Personally he suggested that that policy of proportional subsidies to land values was pernicious. It encouraged an increased density of population, thereby resulting in yet higher land values, which would result at a later date in a demand for still higher subsidies.

He suggested that it was clear that Mr. Head was more concerned with the state of the building trade in London than with town planning, for in the paragraphs of his paper headed "Review" he said: "Unless we are prepared to face stagnation and unemployment in the building trade, some method must be found of restoring site values or, if we desire to quicken up the rate of re-development, of increasing them," and he went on to say: "The majority of sites to-day are so crowded as to offer no further opportunities for lateral expansion, and so the only alternative which remains to us is that of vertical expansion"—a plea for yet higher buildings. "The problem which has to be solved is, therefore, how we may obtain a maximum of height with a minimum of interference with amenities."

Until they wrenched themselves free from that vicious circle of high land values and high density, he suggested that there was no hope of sane town planning. The answer to the riddle, he thought, was essentially simple. It was to be found in the proposition that the first cause of land values was population. Land, other than the physical products of land, was valueless in the absence of population. When the population was increased, land values were also increased. If the population was spread the land values were spread, and that could be done only by spreading industry. Then and then only could one hope to house the vast majority of the workers of the country in surroundings where a normal decent form of existence was possible—cottages with gardens, open spaces, playing fields, space for community centres.

His criticism of the present proposals of the London County Council was that they approached the subject by looking at it through a microscope instead of a wide-angled lens. The only hope for sound town planning in London was to commence with a sound regional planning of an area infinitely larger than the area within the confines of the London County Council boundaries. It was a question of wide vision, of the location of industry not

in London but, it might be, twenty or thirty, or even forty, miles out of London and giving consideration to questions of transport. He thought that Mr. Head himself had given the clue to the mystery when he said that town planning "should aim at the "encouragement of development when and where it is needed." He suggested that "where" was the vital word, and "where" was outside London. The town planning of London was not to be confined merely to the encouragement of re-development. In certain instances, he suggested, the function of town planning was to prevent re-development or development in the wrong areas.

He suggested that Mr. Head would not be so badly off. Instead of making a profit in the centre of London to the advantage of his clients but the disadvantage of the community, he would be able to make a profit in the country to the advantage of possibly different clients (but he would not mind that), but also to the advantage of the community.

It was with very great pleasure that he seconded the motion and tendered his very sincere thanks to Mr. Head for his paper.

Mr. P. W. Macfarlane (Professional Associate), representing the Junior Organisation, said that in accepting the invitation to speak for the Junior Organisation he had suggested that his views would not necessarily be those of the majority of the members of the Junior Organisation, but that he would be expressing his own personal views. However that might be, he was sure that every member of the Junior Organisation would support him in thanking Mr. Head for the paper which he had presented and for the thought which he had put into it. He was not infrequently asked whether he could recommend a paper or a booklet dealing with certain aspects of planning, and whilst he did not agree with a good deal of the subject matter of Mr. Head's paper, he felt he would be acting quite fairly in saying to people "Here is a warning of the terrible things which may, "but we hope will not, happen to you when you re-develop "London." Personally he disagreed with the general attitude of the paper, and with a number of the specific conclusions at which Mr. Head had arrived.

To begin with, he saw a statement in the paper that the present project was the start of planning control in London. He did not think that was quite true, because about one-third of the county of London was controlled by the Planning Resolutions, and in one or two cases there were schemes in operation prior to the passing of the last Resolution covering the central area of London. He thought that was a very important point, because did one find a complete collapse of land values in the areas which had been subject to control in the last few years? Did one find

that all the buildings had become stereotyped, and that everything appalling that was suggested in the paper had happened? He did not think that was the case, and, whilst it might be said that the areas in question were to some extent unbuilt areas, they were largely built up and included a great deal of property in the course of re-development. In fact the proposals appeared to have given a sufficient latitude to justify a number of people in asking what was the good of planning control, and one could not, on the basis of what one saw going on, for one moment accept the statement that planning would lead to stagnation and the slowing down of development. The same applied to other large towns, such as Liverpool, Birmingham and Manchester, which for several years now had had Planning Resolutions covering their built-up areas, and there was no sign of the stagnation which Mr. Head foretold in his paper. He suggested, therefore, that one was not entitled to assume that it would occur in London.

Mr. Head then went on to say that planning control must be positive, and it must do this and it must do that if it was going to be successful, and he concluded that, because apparently it would not do those things in London, its objects would not be obtained. He would like to point out that it was not claimed for planning control under the Town and Country Planning Act of 1932, especially in so far as it applied to built-up areas, that it could be very positive. It was, broadly speaking, the control of activities which were carried on by private individuals, and, that being so, it seemed to be unreasonable, first of all, to ascribe to it a virtue which it did not possess, and then to say that because that virtue would not be in existence in London planning was a bad thing.

It appeared to him that there was a contradiction in the terms "precision" and "flexibility." Having stated that a town planning scheme must be precise, Mr. Head went on to say that it must be flexible. When one actually came to administer planning, one found that one could not have precision if one was going to have flexibility. In another part of the paper Mr. Head complained that so much would be at the discretion of the London County Council. Having asked for flexibility, he did not like it to be exercised by the responsible authority.

With regard to economic considerations, he must, of course, pay due acknowledgement to a speaker with a great deal of knowledge of London and of development. He himself was young and was learning, but he wondered whether the economic laws were really such as Mr. Head had put forward or whether he had not turned them round to his advantage to justify his saying that it was necessary to go cautiously in London. It was suggested that demand was created by what owners did with

their property. With that he profoundly disagreed. In his opinion all owners did was to attempt to satisfy the demand as far as they could with respect to their sites. For example, nobody could possibly say that the demand for the Surveyors' Institution had been created by the owner who sold the site to the Institution. The demand for the building and for the development in question had been created by the desire of a number of surveyors to meet together and to discuss problems of interest to them. Another example that came to mind was the County Hall. Nobody could possibly say that the owners of the site on which the County Hall was built made the demand for the County Hall. That demand had obviously been created by very much wider considerations. He thought that applied generally and that the owners were only attempting to meet the demand which was caused by the great dynamic growth of London and by the interplay of the various forces in all that went on. It must also be remembered that, even if the restrictions did tend to decrease site values (he did not think they did), the demand being constant, the tendency would be for site values to rise and not to be depreciated. In his opinion the height restrictions were quite reasonable, and it was a fact that there were very few buildings which had been erected in the central areas which conflicted with the height zoning proposals. Not only was that so, but the majority of buildings now existing were considerably below the heights which it was proposed to fix. Did it really very much matter whether a building had a flat roof or a pitched roof? If it was going to be 80 feet high and the road 50 or 60 feet wide, would the roof be seen? He did not think it would, so that he did not think it mattered very much in practice whether a building had a flat roof or a pitched roof, and usually there were parapet walls which screened the roof. With regard to the lack of relationship between a building with a pitched roof and a building with a flat roof, he was sure Mr. Head would assist the London County Council by accepting the control of elevations if there should be a question of conflict. Uniformity in the height of buildings in the London squares which were subject to a large degree of private control by the owners as to height was quite satisfactory, nor did Regent Street look particularly bad because there was uniform height control throughout ; and when one saw certain towns abroad one appreciated to a large degree the suitability of that sort of control. It must also be remembered that, whilst old buildings usually had rooms up to 12 feet high, the tendency now was for lower ones, and what used to be a four-storey building had become a five-storey building now. He considered that there was ample latitude, and the actual surveys which had been made in the central London areas justified that statement, in his opinion.

With regard to site cover, that would be the normal method of control and not the exceptional one, and the angular limit would apply only to such buildings as could not be properly controlled by site cover. He could not accept for a moment the statement that angular limit control by itself was sufficient. If there was angular limit control only, it would mean that low buildings of two storeys backing on to one another would have practically no open space in the rear, which would be most unsatisfactory.

With regard to density zoning, it was suggested that densities in excess of 12 to the acre should be allowed. Density zoning was of very little use, in his opinion, in built-up areas, because most of the re-development would be by means of blocks of flats and not terrace houses, and it seemed to him that, if an owner knew that he could not re-develop his own little plot, he would be very much more inclined to get together with others and produce a comprehensive scheme than if he could re-develop at, say, 30 to the acre, which would mean terrace houses and narrow streets. One wanted to see buildings re-arranged round courts and open spaces, and that was not likely to be done if densities of 30 to the acre were allowed.

He did not think there was any justification for the statement that the use of zoning was incorrect, that it would prevent progress and would not provide for the future. He had been privileged to see a number of the plans, and he would like to say, with respect to Mr. Head, that his statements were not correct with regard to the use of zoning proposals. There was ample provision for reasonable extension, and it seemed to him unreasonable to come to the conclusion at which Mr. Head had arrived when Mr. Head had not even seen the use of zoning maps.

With regard to the height of buildings, there was nothing revolutionary in the statement that there should be height control. That question had been debated ever since the War, the chief objection to high buildings not being on account of fire but being on account of the traffic congestion and the congestion generally that was bound to arise when there were high buildings. He sincerely hoped that the present height limits would not be exceeded, because they would provide for ample accommodation in London for very many years to come.

It seemed to him that Mr. Head's attitude was: "I do not like "planning, but, assuming we have got to have it, let us get it "watered down to the greatest possible extent." Mr. Head did not appear, unfortunately, to have any regard for the wider aspects of planning. Nor did Mr. Head make any plea for co-operation with the London County Council. His attitude was rather one of treating the London County Council as an enemy and

as an organisation which wished to be interfering. It was, however, the statutory authority for planning in London, and it would be lacking in its duty if it did not use its powers to their limit. One could imagine Mr. Head's sentiments being expressed in the days of the Public Health Act of 1875, which imposed, at that time, very severe restrictions.

He quite appreciated that it was very much easier to throw stones at someone else's house than to build one oneself, but the foregoing were his opinions and he was very glad to have had the opportunity of expressing them. He hoped that Mr. Head would present another paper to the Institution when there had been an opportunity of seeing how town planning developed in London.

Mr. H. Berry (Chairman, Town Planning Committee, London County Council) said he was very glad to be present that evening, because it enabled him to pay his tribute to the conception of public duty that helped the Institution to play its part in the formation of the new Building Code for London. He was delighted that a great professional institution showed that conception of public duty. He had come to the meeting thinking that he would be like a lonely pelican in the wilderness, and he had been greatly cheered by the last two speeches. In saying he was delighted to have heard Mr. Head's paper he paid tribute to the author for having the courage of his convictions.

Mr. Head (he said) had used such terms in his paper as "at "the mercy of autocratic control," "undefined control in a "democratic country," "dictatorship," and so forth, and he used them with reference to an Act of Parliament, the Town and Country Planning Act of 1932, passed by a democratically elected of Commons not exactly unfavourable to Mr. Head's friends, and also passed by the House of Lords, which had not showwn too much vindictiveness either, so that it had conformed in that respect to a democratic institution. The Act was administered by the London County Council, a democratically elected body elected every three years. How anything could be more antipathetic to dictatorship or autocracy than that, with the possible exception of the House of Lords, he did not know.

Dr. Theodora Kimball, who was an authority on town planning on both sides of the Atlantic, had given the following definition of town planning: "The arrangement for convenience and "comfort of the greater or smaller groups of homes and shops "and roads and parks, so that people who live in cities may "have the fullest measure of health, wealth and happiness." That was a definition of town planning in which he profoundly believed. It was impossible under the Town and Country Planning

Act, which he thought was faulty, to carry out that definition to the full. It was only possible to do the best one could, and the London County Council was trying to do that. He had been duly chastened by what Mr. Chambers had said as to the futility of the London County Council doing anything at all because it could not deal with planning twenty-five miles from London but had only to plan the county of London ; he had found relief, however, by the latter part of that speaker's remarks.

Mr. Head had said: " As schemes are expected to take a con- " siderable time to prepare and to prevent a feverish rush to erect " uncontrolled buildings before the shackles are finally riveted " on," and so on. He thought that, in the first place, that was not quite fair, and, in the second place, it was not quite a correct representation. Riveting the shackles on whom? He had a theory that Mr. Head had been subconsciously influenced in writing his paper. Mr. Head must surely have been thinking about Victorian times, when great London estates and surveyors and agents of London estates simply made their tenants and their lessees shiver in their shoes before them. Thinking of that real autocracy and the real shackles which were riveted on in those days (and might be still), Mr. Head must have been sub-consciously influenced, and that sub-conscious influence had dictated to him some of the terms that he had used in his paper.

As a matter of fact, even the imperfect scheme that the London County Council was putting forward would make London a better place to live in. He did not divide London into the majority and the minority. He had been a member of the London County Council for ten years, and he considered it was the duty of the London County Council to administer the whole of London, without dividing it into classes, for the common good of the greatest number. That was the end it had in view with regard to its town planning scheme.

In some of his criticisms Mr. Head had invoked economic laws. He wanted to ask Mr. Head what density of people he would put per acre in Central London. Mr. Head had not divulged that ; perhaps in his heart of hearts he was a little ashamed of the density of population that he would put there. He (Mr. Berry) thought it was absurd for the London County Council to have to clear densely packed populations in certain parts of London and to treat those areas as re-development areas if other areas were to be packed as tightly as possible. Mr. Head had said that the population was growing, but as a matter of fact the population of the county of London was decreasing. If Mr. Head wanted a working-class population in Central London he could get it by the invocation of the same economic laws as he had already invoked.

Judging by Mr. Head's paper, one would think that there had been no control in London at all.

The fact of the matter was, as had been confessed on all hands, that the London County Council had a most difficult task and needed all the help and co-operation that could be given to it. He suggested that Mr. Head had not given it too much co-operation that evening. He had one complaint to make about some of the London estates. In November, 1936, letters were sent to the representatives of 107 of the larger estates in London, asking for their views on town planning as far as it affected them, and up to that date only 59 replies had been received. It was very difficult to co-operate with people who adopted such an attitude. If any members present that evening felt guilty in the matter, he invited them to repent and act accordingly. The London County Council wanted to co-operate—it was its bounden duty to do so—with estates large or small and with the local authorities, the borough councils, and it also invited the co-operation of the great professional Institutions, such as the Surveyors' Institution, whose professional knowledge should be pooled and placed at the disposal of the community. He thought he had shown in times past that he was always willing to welcome the great professional Institutions, to listen patiently to what they had to say, to learn from them, and he invited the Chartered Surveyors' Institution to give the London County Council all the help it could, so that a better plan for London might be produced than would otherwise be the case. He had been born in what was now the County of London, and he had a great admiration for the history and the traditions of London. He thought it could be made a much better place, and he hoped that when the plan was produced and duly criticised, the outcome of it would be that the London of to-morrow would be a far better place than the London of to-day.

Mr. W. H. Scanlan (Fellow) said he thought that, in writing the paper, Mr. Head had in view the idea that it would be wise to enter upon a criticism of the possible working of the Town and Country Planning Act, in the hope that it might be helpful for the future. He wished to deal very briefly with some of the conclusions at which Mr. Head had arrived as stated in his paper. First, he stated that planning would check progress in building. Personally he thought that was probably true, and it was borne out by Mr. Head's analysis of the effects of town planning on values. The value of a site must depend upon the cover and the rental value of the buildings, and if future buildings were to be less in any area than the existing buildings there would be a lower rental value and a consequent diminution in site value.

With regard to the question of control, he was sure that Mr. Head appreciated the difficulties of control in the development of London and at heart really wanted it to be flexible. He knew that Mr. Head understood that it was impossible to lay down any hard-and-fast set of rules as to development, and the London County Council and everybody in charge of the schemes must have a certain amount of latitude. In different areas different factors applied to development, and it must therefore, he felt sure, be left to the judgment of the controlling body to decide what was best for a particular district, having regard to the general rules which were laid down for town planning in that section of London.

He wished to join with the other speakers in thanking Mr. Head for his paper.

Mr. R. S. M. Humphrey (Professional Associate) said he was very grateful to Mr. Head for his instructive paper. He felt bound to say, with great respect, that he disagreed with the general purport of it, although he agreed with many of the details. There were three points in particular which had struck him.

Mr. Head stated that the restrictions proposed were far greater than those imposed by the London Building Act and similar Acts. As a matter of experience, those Acts had proved to be insufficient, and he supposed that greater restrictions were to be justified on that ground. But later on, in the same connection, Mr. Head complained that the London County Council was unduly arbitrary or was likely to be so when its scheme came into force. He thought it was only fair to bear in mind that for several hundred years and until recently private enterprise had been quite unrestricted except by the London Building Act and similar Acts, and a fearful mess London was in to-day! He did not hold any brief for the London County Council, but he thought it was more or less forced to be arbitrary.

Secondly, Mr. Head complained of the restriction of heights, site cover and density, and said that that tended to make a stereotyped pattern. Personally he entirely agreed with that. He believed that town planning was an art, and he did not think that strict control would produce the desired results. He regretted that the London County Council, as far as he knew, did not have the advantage of the experience of architects and town planners not connected with the Council. With great respect, he did not feel that the officials of any Council or the Councillors themselves had quite enough expert knowledge to do the best that could be done with an extremely difficult situation.

Finally, he felt he must protest against what he considered to be a wrong limitation in the use of the words "value" and "profit." It seemed to him that Mr. Head limited the meaning

of the word " value " to market price and of the word " profit " to cash profit. He thought that was absolutely wrong. To take an example, a public park had no market price and there was no cash profit derived from it, but a public park was very valuable and very profitable to the community at large. Again, Mr. Head spoke of the artificial depreciation of the value of sites by town planning. He must confess that that was quite meaningless to him. It seemed to him that, properly regarded, the value of a site rested on something more than the maximum cash profit which it would bring forth. He thought it was the maximum market price of the site, assuming that it was absolutely unrestricted, which was artificial, and that the proper control of the development of a site reduced that artificial value to a real value. In his mind the whole purpose of town planning was to make sure that sites yielded their true value, not only from a financial point of view, but also from every other point of view.

Mr. E. C. Trotman (Fellow) said that many years ago, when he had the traffic problem of London under consideration, he had heartily subscribed to the view that the rehousing of the people of London should take the form of blocks of flats in the central area rather than the form of estates and houses in the outlying suburbs. He must confess that since that time he had entirely changed his views. It must also not be forgotten that in the event of any international disturbance a bombardment, instead of killing tens, would kill hundreds.

Mr. H. G. Buss (Fellow) identified himself with the vote of thanks which had been moved, and referred to the increasing degree of control which was being exercised in every aspect of industrial and social activity at the present day.

The vote of thanks was carried by acclamation.

Mr. G. Leslie Head, in reply, said he had listened to the discussion with very great interest and certainly knew more now than he had known that morning. He hoped he would be able to put to good use the knowledge that he had acquired. He felt somewhat like a certain gentleman in fiction who sat aghast amongst the spirits that he had conjured up. As the hour was late and he had not got a full note of what had been said, he would like to answer the discussion in the *Journal*.

The following written replies have been received:—

From Mr. G. Leslie Head—

I notice that Mr. Chambers reminds his brethren that the whole town planning policy of the country is based upon the control of economic laws and not upon the harnessing of them. If a distinction is to be drawn between these two operations he must mean, by control, the forcing of an economic law from its natural course. If he does he is trying to make water run uphill and is confidently expecting that it will do so in order to oblige him.

He also apparently sees no reason why a high density should be permitted solely on the ground of high land values. I do not think that these factors can be dissociated from each other, but if he can indicate any normal cases where low densities can be profitably obtained upon expensive sites he will be rendering an invaluable service to his profession and to the various town planning schemes.

He also comments upon the fact that high land values have not produced cottages suitable for the working classes. I do not suppose that they will. He would have to bend his economic laws very considerably before he could find a community willing to accept a return of 1 per cent. or less upon weekly properties when they can get 3½ per cent. from gilt-edged securities.

Mr. Macfarlane made the point that at least one-third of the area of the County of London was controlled by town planning resolutions prior to May, 1935, and that there had been no startling collapse of land values or any cessation of building activities. The reason for this is not far to seek. The money market and demand for accommodation are both favourable to a boom in building, and practically the whole of the areas which he mentions, together with the rest of London, are not yet controlled by a scheme but by interim development under which more extensive concessions are granted than may be expected later. He has admitted that very considerable concessions have been granted, so much so as, to use his own words, " to justify a " number of people in asking what was the good of planning " control."

Perhaps Mr. Macfarlane would give us examples of voluntary re-development on the sites of existing buildings under an operative scheme in London or anywhere else in the United Kingdom where the regulations are as onerous as those now proposed. And, perhaps, in order that we may complete our appreciation he would be good enough to indicate the extent to which relief was granted to his examples.

Mr. Macfarlane, in common with other speakers, appears to

regard flexibility and discretion as meaning the same thing. If he will read the paper again, he will find that a distinction is drawn between these two terms. This remark applies also to the comments of Mr. Scanlan.

Mr. Macfarlane tells us that he had been privileged to see the use of zone maps for the London schemes. It cannot, therefore, have escaped his notice that there are large residential areas in densely populated districts where flats are not to be permitted, and his assumption that most of the re-development of these areas will be by blocks of flats, while economically sound, is not in accordance with the present ideas of the Council.

It is unfortunate that Mr. Macfarlane should have derived the impression that—

(*a*) I do not like town planning in principle ;

(*b*) I do not make any plea for co-operation with the Council ; and

(*c*) I regard the Council as an enemy: of what he does not say.

Nothing could be further from the truth. Wisely used, town planning must be beneficial to the community, but used ill-advisedly it can be a danger. It is against its ill-advised use that I directed my paper. As to co-operation, Mr. Macfarlane will find that I have put forward a constructive suggestion to deal with every criticism which I have made. Lastly, I consider that it would be in the highest degree foolish to regard the Council as an enemy. I regard it as an ally, striving to gain the ends which we all desire, but working upon lines which I consider to be open to criticism.

If Mr. Berry will read my paper again, he will find that my criticisms are levelled not at the Act but at the schemes, and that they refer not to the constitution of the Council but to the arbitrary powers which it proposes to assume. He appears to object to my reference to "shackles," and points out that, in his opinion, the real shackles were riveted in Victorian times. He implies that under town planning the burden of those shackles will be eased. If he really believes this, why can he not wait until the schemes are thrashed out and ready before imposing control? Why must he make use of an Interim Development Order to assume instant control if he did not think that there would be apprehension in the minds of developers that the unknown shackles of the future would be heavier than those clearly defined and voluntarily assumed ones of the past?

Mr. Berry refers to the outcry which greeted the London Building Act when it was first passed. Perhaps this outcry was not justified, perhaps it was, and in some respects perhaps it still

is. But there is at least this to be said for it: It does not contain a disproportionate amount of undefined control.

Mr. Humphrey, in his concluding remarks, hit the nail on the head when he said that the purpose of town planning is to make sure that sites yielded their true value from a financial point of view. If they are not to be allowed to do this they will not be re-developed and the old buildings will remain.

From Mr. W. A. LEACH (Professional Associate)—

The effect of the Interim Development Order is not to prohibit development without consent. The Order merely lays down the rules for dealing with applications to develop, and restricts the powers of planning authorities to refuse consent. There is no prohibition of development even under the Act itself during the Interim Development period, the strength to control development arising only indirectly out of the right to require the removal of unauthorised development without payment of compensation as soon as a scheme becomes operative. It may be of interest, however, to note a further indirect method of control outside the Act ; where a waiver is required under the London Building Act in circumstances in which prior to the advent of Town Planning the London County Council would probably have granted the waiver, this is now withheld if the proposals are not in accordance with the Council's town planning views. A measure of town planning control is thus obtained over works of an inexpensive or temporary nature in respect of which the owner is prepared to disregard the Interim Development procedure.

It is agreed that the Act is not conscriptive (apart from Section 13), but given a piece of land with building value and a right to erect thereon only certain classes of buildings, will not these buildings be erected with or without any special encouragement? The economic argument on pages 142 and 143 is unsound, as also are the analogies. The economic factors affecting dealings in property in this country arise out of a system of ownership, letting, and taxing devised by man, and the economic laws referred to by Mr. Head are not natural laws but in reality no more than by-laws of this man-made system. There is no comparison with the law of gravity, but as regards that analogy, even if an Act of Parliament cannot yet provide for an apple to fall upwards, it can provide for the building of aeroplanes to overcome temporarily the law of gravity. The essential point of all this is that if it is desired that building shall continue to attract the funds of investors, it must not be rendered incapable of showing a reason-

able return or profit. That expresses briefly a truth which most people would accept as axiomatic without any dissertation on or special understanding of economic laws.

It is presumed that in page 143, paragraph 2, Mr. Head is not suggesting that in London there is no development for town planning to control.

As regards his reference to the driving force of encouragement, the foundation for undertaking the town planning of built-up areas is that in the past the encouragement has been too liberal to the developer and too prejudicial to the public. That, of course, is no discredit to past developers ; they built to fulfil a public demand for buildings and to the standards of their respective days. Co-ordination, foresight, and sociological knowledge and understanding should come from authority, and in town planning authority is now endeavouring to remedy the errors of the past. If necessary action on their part were to discourage building as an investment, that *alone* would be no ground for their not proceeding with their planning ; what other methods would have to be adopted to avoid " the cessation of development " and " stagnation " and to what extent compensation should be paid to owners are questions not at the moment under consideration. If town planning is worth having at all it must be honest to its purposes and not framed with a view that it " will induce a " developer to implement the ideas of the authority " unless that is possible without undue sacrifice of its purposes. The economic argument only arises in so far as it can be applied consistently with the objects of town planning and the ability of the authority to pay compensation in appropriate circumstances.

The argument on page 146 is that there must be a continuous rise in site values in order that owners may be encouraged to demolish old buildings before they reach " the final stages of " decreptitude." If on every rebuilding the site has to take on part of the value of the old buildings, it would perhaps be as well that rebuilding should be discouraged to avoid excessive rents. The truth of the position is that where rebuilding has been undertaken in the past, then either the old buildings were " in the last stages " of decrepitude " or there have been changes in the character of the neighbourhood with resultant increases in site value leading to the scrapping of the old buildings. The same process will continue with town planning in operation. The suggestion that buildings are retained in use which ought to be demolished only implies that the " dangerous structure " provisions in the London Building Act, the nuisance provisions in the Public Health Acts, and the various powers under the Shops Acts, Factory Acts and, most far-reaching of all, the Housing Acts, are inadequate for their purpose. If that were so, the position could, of course, be remedied.

One might also look critically at the suggestion that " high land " values will tend to encourage re-development." A point might be reached, as in Regent Street, where the land values are uneconomic, and if that arose generally re-development would stop until land values had fallen to a more reasonable level. If the rent-paying public could afford the higher site values, is it not probable that the demand for modern accommodation would force up rents of new buildings to a level when re-development would be equally as profitable as at present.

If the suggestion in paragraph 2 of page 147 is that the population of Inner London should be increased, it should be remembered that the traffic problem is not the only one. Space for parks, playgrounds, sports grounds, allotments and schools would have to be increased.

It is open to doubt whether, when the London schemes become operative, they will be found " to be framed for the express " purpose of being infringed by consent." It will probably be found that with an approved code to work on, infringement will only be allowed in very exceptional cases ; during the Interim Development period, without an approved code, a concessionary attitude as regards the proposed provisions of the scheme would not be unnatural.

In referring to height limits under the London Building Act, mention should not be omitted of the restriction under Section 53 45 degrees from the opposite side of the road applicable to streets less than 50 feet wide laid out after 7th August, 1862.

As regards the proposal to limit height by a number of storeys, this would still leave it necessary to obtain consent for the tank house in excess of the permitted number of storeys ; of course, tank and lift motor-houses might in either case be included with chimneys, turrets and architectural features as exceptions from the height limitation. The limitation of height by storeys provided for in the Model Clauses of 1935 is omitted from those of 1937, so that Mr. Head does not seem on very strong ground here. Usually where authorities have provided for a storey limitation they have provided also for a dimensional limitation.

Mr. Head appears to overlook the fact that a parapet is included in the height limit, and that to take full advantage of the height limits it is probable that a mansard roof requiring no parapet will be erected so that no loss of pitched roof need be anticipated. Also, except where the building line is set back, the majority of buildings will be subject to the angular limitation which will result in stepping back the front or forming a pitched roof, thus adding interest to the elevation. The differentiation in heights of different classes of building is not illogical, but the application of a similar

angle to all classes of buildings in each zone is extremely so. It may be mentioned that the objects of the height limitations are in addition to that mentioned by Mr. Head, viz., forming an angle of light to the lowest windows opposite, to secure light and air in the streets, and to secure buildings of a height in relation to the street width to harmonise with the character of the area.

Mr. Head is hardly correct in his assertion that if in fixing the maximum height of a building by the angular limitation the width of the street plus twice the forecourt were to be taken, this would be the same as the Council's proposal for fixing the height of buildings at rear. The London County Council proposal for rear of buildings is that the rear boundary is regarded as the centre of a street ; if one owner sets back further from his rear boundary than his neighbouring owner at rear, he alone reaps the benefit of greater height in respect of the additional set-back, and the additional set-back has the same effect as a private forecourt under the London County Council proposals for the angle at front.

The angular limits for internal courts are so obviously a matter for the Building Act that the whole of these provisions should be deleted from town planning proposals.

Mr. Head is hardly correct in his three cases (*a*), (*b*) and (*c*) on page 153. It will be found that in the case of commercial and industrial buildings the angular restrictions will usually be more restrictive than the cover restrictions, particularly so in the case of shallow sites ; in the case of residential sites the cover restrictions will usually be more restrictive than the angular limits, and the main application of the latter will be when the building is near to the front or rear boundary. Both forms of restriction are accordingly necessary in order that their respective objects may be achieved, for one is not concerned with merely securing a minimum measure of light and air but of limiting the density of population, of limiting the street traffic according to the character of the street, and of preserving a degree of openness compatible with that character.

If the London County Council cover proposals were amended in accordance with suggestions at a recent City Branch debate, the objections raised on page 154 would be removed. It may also be noted that the flat and square style of architecture for blocks of flats began before town planning, and Mr. Head's fears are disproved by the present tendency to break away from the flat style, and introduce breaks and balconies as a concession to the public objection to "barracks." What objection is there to basements for boiler-house, stores, &c.?

The suggestion on page 155 hardly makes for simplicity. Mr. Head agrees that if the habitable area were measured for the cover percentage, economic laws would prevent excessive space

being taken up for non-habitable space. Is this result in fact not exactly the same as he suggests will occur where the whole habitable and non-habitable area is included in the cover percentage? In either case entrance halls, corridors, &c., would be provided according to the character of the building and what would be required to attract tenants. The heavier restrictions arising from the acquisition of a forecourt by the Council are usually provided for by an undertaking as to permitted cover on re-development. It is, of course, for the Council to choose whether they will give such an undertaking or pay higher compensation.

The suggestion to include roads in the area is wholly illogical. In fixing a percentage for site area there is equity as between sites; if roads were included, there would be no equity, and with a sufficiently wide road or a corner site or an island site, the cover under such a method might be more than 100 per cent.; it would therefore be necessary to fix in addition a maximum percentage based on site area, and this might as well be fixed first and alone.

It is not illogical to exclude public roads, but it is illogical to include private roads forming the main approach to a building. The inclusion of private open forecourts is logical since the owner has rights over them as frequently utilised by shopkeepers. The developer still has to comply with angles at rear, and he is in the same position as an owner who, having no forecourt, builds to set back building line. The difficulty of excluding private roads probably lies in the probable liability to compensation ; thus, if the percentages are reasonable for the majority of properties which abut on to public roads, a small minority are getting exceptionally lenient treatment, but this does not prove the main effect of the regulations to be illogical.

Whilst not agreeing with the London County Council percentages, Mr. Head's arguments are not justified. The height angles in the case he cites are applicable only when the building is near the front or rear boundary and the main restriction is sought through cover limitations. Further, his hypothetical building 60 feet high to a depth of 40 feet would require an internal light well, so that the actual average over-all building depth might be 50 feet. Under the London Building Act an angle at rear of 63½ degrees would be required, so that for a building 60 feet high a rear area 30 feet deep would be necessary. Also, assuming a 40-feet street, it would be necessary, in order to erect a building 60 feet high in Zone B (ratio 1¼: 1), for the building line to be set back 8 feet. The total site depth necessary for the building would therefore be 88 feet, not 70 feet, so that the site cover restrictions necessitate an increase not of 71 per cent. but of 37 per cent. As this applies only to residential buildings, commercial and industrial buildings being usually more restricted

by the height angles than by site cover, and dwelling-houses being usually within the site cover percentages (except in case of small sites for which special increases will be allowed), it is far from the truth to say that 60 per cent. more area would be required to rebuild London under the new site cover and angular restrictions. Probably 25 per cent. to 30 per cent. would be a very full estimate, and if this resulted entirely in a diminution of site values that reduction would be not more than, say 20 per cent., not 35 per cent. to 40 per cent. It is, however, problematic what the effect on site value will be. In Regent Street site values have been built up on the basis that development is possible to the limits of the London Building Act and that tenants can be found to fill the buildings. If the available accommodation were reduced, then presuming the tenants are in Regent Street because for business reasons it pays them, some will be found to pay more to remain in that street. The others would have to move to secondary areas for which the greater demand would lead to higher rents, and these rent increases would at least in a measure compensate for the reduced building cube. In suburban shopping centres one finds lock-up shops, shops built out over the gardens of old cottages, and shops with one, two or three floors over. From this variation it seems probable that the bulk of the site value is carried by the ground floor, and as the permitted cover here will be 75 per cent. to 90 per cent., no serious reduction in value is to be anticipated. As regards housing, the maximum proposed by the London County Council is 16 houses to the acre. with general provision for flats where the existing housing density exceeds 16 houses to the acre. Here again, therefore, no sweeping reductions in site values seem likely to accrue as a result of the London County Council proposals. The sites mainly affected would appear to be those which have already acquired a value for flat development under Building Act limitations. As modification of the proposals can, in fact, be justified on other grounds, it is probably unwise to attempt justification on the basis of a reduction of "site values," a term which is to-day practically a political platform, and the very mention of which is sufficient to ensure a case being howled down even if thoroughly fair and logical.

The comments on page 158 entirely overlook the objects of the density restriction (sufficient land for planning for sunlight to principal rooms, adequate garden for cultivation and young children's playing space, freedom from close oversight at rear, and economy in street lay-out by planning streets in width and construction according to traffic needs). Presumably Mr. Head will leave owners free to plan thirty or forty houses to the acre as in the past with small back yards. The obvious solution to this past congestion is replanning with flats on larger sites so that the

uncovered space can be of proper value, but where houses are to be built the old basis must be regulated out of existence.

Mr. Head refers to powers which Parliament would not knowingly have granted. As the powers under the 1932 Act are similar to those which were made available under the 1925 Act, it is difficult to see how Parliament could have been in any way unaware.

Town planning is not intended to be static, and to assume it to be immutable for 200 years is paying small tribute to the intelligence of posterity.

The proposal to abolish maximum height and cover limitations is probably outside the realm of practical politics. What surveyors have to do is to propose reasonable modifications of restrictions under all headings The proposal is in fact made on an incomplete realisation, or, at any rate, an incomplete acceptance of the aims of town planning.

The attitude of the London County Council in refusing to deal with applications without the authority of the owner is perfectly justifiable, and the mentality of the agents, who will submit schemes to the Council without the authority of the owner, is difficult to understand. My own view is that it is grossly impudent and improper.

Paper 583.

THE BASIS OF MAP-MAKING: SURVEY OF CONTROL.

By G. T. McCaw, C.M.G., O.B.E.

Paper to be discussed at the Ordinary General Meeting of the Chartered Surveyors' Institution on Monday, 4th April, 1938.

It is far from the object of this paper to attempt either an historical study of map production or even a technical description of map construction. Both of these subjects are far beyond the scope of any paper. Successful map-making, however, is dependent on survey, and on survey in two forms: there is the survey of the detail, which is that which appeals to the ordinary map user; but there is also the survey of a general framework into which the detail can be set so as to stand in proper relation to the mapping of adjoining areas, or in a broader sense to position on the earth's surface. The construction of this framework constitutes the survey of the control on which the general accuracy of the detail mapping is fundamentally based.

Thus limited, the subject is still much too big to be treated in a short space of time. There are, however, some aspects of it, of a nature mainly historical, which are worthy of contemplation, since an historical view-point often reveals features otherwise perhaps concealed; but here, again, it would be futile to aim at a complete history of the development of control.

The story of survey in ancient Mesopotamia and Egypt would be illuminating were it complete. Too little is yet known of it, but plans have been found in Mesopotamia,

though not in Egypt. Although engineering survey had probably an independent development in Crete, there is little doubt that Greece took its methods of land survey from the older countries named. Greece, however, bequeathed to the world a marvellous academic text-book on the subject: let it not be forgotten that the only ancient text-book of science not yet entirely ousted from modern schools dealt with Geometry, *i.e.*, land measurement. The Greeks, moreover, introduced the water-level, if, indeed, they did not conceive it. But of the actual field work of the Greek *harpedonaptes, i.e.*, rope-stretcher, apparently very little knowledge is obtainable. That other Greeks besides Euclid attached importance to survey is put in evidence by Philo of Alexandria, who, though not a Greek, was imbued with the spirit of Greek philosophy and science; according to him survey was the mother of all the sciences. It is to the Romans, however, that the world was chiefly indebted for practical progress in survey: the Greek conceived, but the Roman executed.

The Roman sages considered their kinsmen, with some justice, as rustic unlettered people. Nevertheless, in administration, law, engineering and survey they outdistanced all their predecessors. Their interest in survey appears to have been due primarily to their conception of order. To be sure, they borrowed the water-level from the Alexandrine Greeks and there is some evidence that their principal instrument, the *groma,* had a crude prototype in Egypt. The *groma* was composed of four plumb-lines, set orthogonally in pairs, and suspended from a horizontal wooden cross supported at its centre on a vertical pole furnished with a pointed metal shoe; a model may be seen in the Science Museum. The Roman military and road surveyors were named *gromatici,* in contradistinction to the land surveyors or *agrimensores.** In speaking of the wonderful roads constructed by the Romans it must

* The work of the *agrimensores* has been already examined by Mr. Reginald Woolley in his excellent paper published in the *Transactions,* Vol. XVI., p. 191, 1884.

not be forgotten that the Greeks also had road surveyors; but there appears to be little evidence that the *bematistai, i.e.,* pace-measurers, of Alexander the Great were ever employed on civil duties, though it would be surprising were it not so. Moreover, the accuracy of their work has been questioned, on the ground that nothing more was expected from them than an approximation to the length of a route march; their very name, however, suggests the absurdity of supposing that they measured distances on a time scale, particularly in the absence of timekeepers. But Greek conquest and Greek genius did not include the making of great roads.

The Roman *gromatici* were employed during peace on civil duties of a nature both administrative and geodetic. Among them the establishment of control had an interesting origin—a development which was native to the race. For military and other reasons, by laying out with the *groma,* the Roman camp was made square, but it was oriented for a special reason. Caesar soon found that the plan of attack favoured by the Gauls was to surprise the camp before sunrise by an assault from the west; in the dark before the dawn they had thus a clear view of the position against the eastern horizon, while they themselves were in comparative obscurity. To meet such attacks, one side of the square was laid out to face the west. The orientation was, of course, never precise and, indeed, may have varied with the sun's position, yet it was directed sufficiently to admit of naming the two axes. The north-south axis was called the *cardo maximus* and the east-west axis the *decumanus maximus*. The word *decumanus* is attractive: used substantively by the Romans it meant the line of the tenth cohort, and was so called because Caesar stationed his most reliable troops near the western gate. From this simple beginning arose the Roman system of survey of control. The name "decuman" is now applied in survey to the great circle—or, more correctly, the "geodesic"—perpendicular to the meridian at any point.

A most instructive account of the Roman system is given

by Dr. Eng. R. de Caterini in the *Rivista del Catasto e dei Serivizi Tecnici Erariali* (May-June, 1935). With this admirable paper there is shown a plan on the scale of 1/50,000 of the colony of Agricola from Imola to Faenze, small towns through which passes to-day the main-line railway between Bologna and Rimini. The *cardo maximus* and *decumanus maximus* intersect at the *umbilicus coloniae* in the middle of the small town of Lugo. Parallel to the N.-S. axis are the *cardo secundus, tertius,* &c., and similarly parallel to the E.-W. axis are the *decumanus secundus . . . . quintus,* of which the last followed the Via Aemilia connecting Imola and Faenze. A glance at an atlas will show that the orientation is very far from cardinal. But here is a true grid, a system of perfect rectangulation. It is curious to find, twenty centuries afterwards, that a grid system is sometimes regarded as a comparatively recent development of survey.

The large squares between the main grid lines, *maximus, secundus . . . quintus,* have sides of a length of 12,000 Roman feet = 11,673·6 English feet = 3,558 metres. These large squares are sub-divided into 25 small squares, of which the sides are 240 Roman perches (of 10 feet) = 2,334·72 English feet = 711·6 metres ; while the area of the small square is 200 *jugera* = 125·136 acres.* The detail survey comprises the towns, villages, rivers, roads, &c., all carefully plotted within the squares of the general framing. The total area of the settlement is apparently 510 sq. km. or 190 sq. miles. There are many of these colonies in Italy, laid out for the occupation of men who had participated in the wars of the Empire.

Were there any such " colonies " in Britain? There were certainly a few, but except perhaps at Colchester they were not intended as military settlements purely or even primarily. The London *territorium* was laid out, in part at least, under the general direction of Sextus Julius Frontinus, perhaps the most distinguished of the *gromatici,*

* For these calculations the Roman foot has been taken as 0·2965 metre = 0·9728 English foot.

who was Propraetor in Britain from 75 to 78 A.D.; his writings included a treatise on surveying of which some excerpts are extant. For a description of this settlement all surveyors and antiquaries owe a debt to Sir Montagu Sharpe, in whose work *Middlesex in British, Roman and Saxon Times* (London, 1919 ; 2nd edition, Methuen, 1932) the results of his investigations are set out. In this scheme, which included parts of Buckingham, Hertford and Essex, as well as Middlesex, the rectangulation was divided up into a dozen separate grids, departing in general considerably from the cardinal axes, in order to adapt them to the local relief. Three of the main divisions, known as *pagi,* are complete in so far as each contains 50 *possessae.* The *limites quintarii* which bound a *possessa* were spaced at 611·882 *perticae,* the Roman perch being 10 feet in length. Each *possessa* contained 1,300 *jugera* or 2,600 *actus,* the *actus* being a plot of 12 perches square. Since the *possessa* was greater than the regular *saltus of* 2,500 *actus,* it was deliberately chosen so as to admit of an excess of 100 *actus* for accommodation roads and paths. The area of the *possessa* was 813·384 acres, which, curiously, is very nearly $1\frac{1}{2}$ square Roman miles, its side being about 4 yards longer than 9 furlongs. The *saltus,* or cultivated part of the *possessa,* was divided up by the *agrimensores* into 25 *centuriae,* each a square of 100 *actus* or 31·284 acres, which was generally re-divided and apparently assigned to the settlers by lot. If, as in Britain, the ownership of the land was vested in the Emperor, the taxes were paid to the Procurator Fiscal ; if the Roman Senate held the ownership, the taxes were collected by the Quaestor.

It will be seen that this survey and fiscal system was thoroughly worked out by the Romans. The quintarial ways constituted the main grid and consequently the control with which this paper is concerned. The evidences of this system as revealed by Sir Montagu Sharpe are of exceptional interest. The outer quintarial ways were defined by mounds of earth (*bottontini* or *monticelli*), of

which four are illustrated in the book—Syon Park, Hampstead, Cranford House (park) and Salt Hill (Slough). The exact site of the station on the mound was marked by a hole filled, say, with charcoal. One of the most interesting of these tothills, which stood on the site now occupied by St. Ermin's House, was in existence up to the reign of Henry VIII. The internal quintarial lines were indicated by stones, holes (*arcae*), cuttings (*fossae*), or trees (*arbores antemissae*). Of the stones, London Stone is the most famous, but there were many others, such as Wealdstone, Headstone, Whetstone, Heathstone, Oswulf's Stone; about a score are known by name, though four only still stand. Of the trees, the several Gospel Oaks, Burnt Oaks and Old Oaks, preserve the names. But there is another remarkable feature of these quintarial ways or *semitivae*. The Romans encouraged the building of little open shrines, which served also as rural clubs; here Silvanus, Ceres and other rustic deities were worshipped, care being taken to include the name of Caesar. With the introduction of Christianity these *compita* were replaced by Christian churches, and so the investigator in the London *territorium* has found 48 parish churches indicating the lines of the Roman grid. With these aids and the present or past existence of old rural ways, the lines of the ancient Roman grid system have been re-established. Such work should form an entrancing study for the leisure hours of surveyors in other Roman towns.

To come down to a much later day one finds rectangulation in use in the United States. There it is said to have been introduced about 1764 by a Colonel Bouquet, a Swiss officer in the British service. The system was inaugurated by an Act of Congress passed in 1784 for the survey of the Public Lands, whereof there are 29, which are evidently not coterminous with the States. Under the system prescribed, with which Thomas Jefferson appears to have been in some measure identified, the Public Lands were to be divided by north and south lines run according to the true meridian and by others crossing them at right angles

so as to form " townships " six miles square. These townships were to be sub-divided into thirty-six sections, each of which was to contain six hundred and forty acres, as nearly as may be, by a system of two sets of parallel lines, one governed by true meridians and the other by parallels of latitude, the latter intersecting the former at intervals of one mile.

These Public Lands, the survey of which is controlled by a federal department, are a remarkable example of over-riding the States.

This definition was very complete and its meaning perfectly clear; the only objection to it was that it presented a problem in geodesy incapable of solution. Congress, however, stuck to its point and surveyors had to make the best of it. It pre-supposed parallelism of meridians; moreover, the setting out of parallels of latitude demanded off-setting from great circles perpendicular to some meridian. The methods of approximating to the law doubtless varied much at the beginning, but were eventually more or less standardised in the last century. The scheme, being based on the graticule of meridians and parallels instead of a grid, could not be both rectangular and equal-sided; it was not, therefore, a true rectangulation. The component figures were trapezoids and not squares.

From a practical view-point it was nearly good enough, and in any event the phrase " as nearly as may be " left some latitude, though not all of it was of the nature conceived by the legislators. The drawbacks of the scheme are: (1) the difficulty of laying it out, and—much more important—(2) the numerous discontinuities to which it gives rise.

The scheme was introduced into the prairie provinces of Canada in 1871. Here the first meridian was placed at 97° 20′ 30″ W., the second very nearly at 102° W., the third at 106° and subsequent meridians at 4° of longitudinal difference. The " township," as in the States, is 6 miles square ; but owing to a variation in road allowances,

both as regards number and width, and differences in the method of sub-division, there are actually five systems in Canada, including British Columbia. The main features of the scheme are preserved throughout, but, naturally, the variations add to the number of discontinuities. The absorption of the convergence of meridians by the use of the " jog " is one of its attractive features. The scheme is controlled by the Dominion Lands Surveys Act of 1908.

The main control in the Canadian system is dependent on the correct running of the meridians at each 4° of longitude and the correct setting out of the base lines (parallels of latitude) at intervals of 24 miles (4 townships) along the meridians. The work thus consists of long traverses, with frequent astronomical control of bearings, and the offsetting of the parallels. The fundamental parallel is the 49th, between Canada and the States. Having run the meridians and set out the base lines, the surveyor divides up the area according to the system in vogue in the region and thus fills in the cadastral detail.

Rectangulation is also adopted in India for riparian lands on the lower Indus and possibly for some other areas. Here the scheme follows the principle of the grid and not that of the graticule. The rectangulation is therefore true, but since the orientation is controlled by the nature of the terrain, it does not conform to the usual type of grid, in that the lines bear no special relation to the cardinal axes.

In considering a true grid system, oriented with reference to a meridian in the locality, the surveyor is still faced with a slight difficulty if he proposes to use this grid as a basis of control for the survey of detail. To be sure a grid postulates a rectangular system—but on a map only. A system of true squares on a map is projected from corresponding points on the ground; and these latter do not form perfect squares. None the less, the figures are very nearly square on the ground, provided that they are not more than, say, 200 miles from the meridian or parallel or origin which determines the nature of the projection. Within a belt or zone of 350 miles in width a grid system

does admit, theoretically, of the lay-out of nearly perfect rectangulation, without any necessary discontinuity.

When the area to be covered is large, the surveyor who attempted to set out such a scheme on the ground, without external aid, would find the task practically insuperable. To apply it to Britain, for example, simply by measuring a system of squares, would transcend the efforts and ability of any body of surveyors if sufficient approach to accuracy were to be sought. It must be remembered that the American solution was no more than an approximation; moreover, at the time when the American lands and prairies were thus parcellated there was no general control available, and the readiest means had perforce to be adopted to place the settlers on the land. The Roman and later work applied to areas comparatively small; even in America the gores or *fuseaux* (areas between meridians) had to be confined in breadth and were limited in depth. It follows that for control of modern precision some other method of survey had to be devised, unless the extent of the development was small.

The Middle Ages had to run their course before an improved method of controlling surveys was discovered. It sprang from Louvain, where Rainer Gemma-Frisius (1509-1555), professor of mathematics and teacher of famous men like Mercator, first described *triangulation*, the modern method of control. Some of the teachings of Gemma-Frisius in 1533 were made known in this country by English pupils like Dr. Wm. Cunningham of Norwich, and John Dee of Cambridge and Mortlake. But it was a practical self-educated old gunner of the " boltwork " at Tilbury, named Wm. Bourne, who, in 1567, was the first to put the ideas from Louvain into actual operation. Selecting West Tilbury Church and a mill at Gravesend on the other side of the Thames as two trigonometrical stations, he showed how the positions of churches and mills around on both sides of the river could be fixed by intersection from his selected " trigs." Distances were given by a " skell or tronk of mesur " on the chart in his *Treasure*

for Travailers, 1578. Bourne's work was of the simplest nature, as, indeed, he apparently intended it to be. A much more regular triangulation was to follow.

The geodetic triangulation executed by Willebrord Snel van Roien in the Low Countries in the years 1613 to 1617 was undertaken to determine the earth's dimensions. It has been fully described in the *Empire Survey Review* (Vol. I., No. 3, January, 1932) by the Rev. A. J. Potter, who has collected all the available evidence. Thenceforward, from 1617, the principle of trigonometrical control was firmly established. By this means positions can be fixed relatively to one another with a precision utterly unattainable previously. As an example of this accuracy it has been found that the old (1858) and the new (1936) triangulations of England, when founded on the same base-length, differ from one another in the whole length of England by little more than a yard.

Triangulation being so well known, it would be out of place to refer at length to it here. A few remarks may be added. When the whole of the countryside has been covered with a net or framework of primary triangulation, the vertices of the triangles are in general too far apart to be convenient for filling in detail, either cadastral or topographical. The main net, the modern control, has thus to be "broken down" to a secondary net with shorter sides filling the large interspaces. Even this secondary net may be of a mesh too large for convenience in surveying the details, so that a tertiary net may be required. But when the work is carried through properly, the secondary net is rigorously adjusted to the primary, and the tertiary net adjusted by simpler methods to the secondary.

The whole of the stations thus fixed are then laid down on some suitable projection and their positions "co-" ordinated" with respect to a meridian central to the whole area and some point on that meridian as the origin of co-ordinates. Off these stations any configuration, such as a system of rectangulation, could then be set out on the

ground with the assurance that errors would not be allowed to accumulate.

Occasionally it is not possible to carry out triangulation. This may happen in densely forested country, in large areas of swamp, and in other special circumstances where commanding features do not exist. In areas such as these the surveyor resorts to precise traversing, unless, of course, in large swamps, where air survey constitutes the only possible means of mapping. Precise traversing has been conducted with such accuracy in recent years, closures of 10 feet in 100 miles being uncommon, that it is now as accurate as secondary trangulation, and as such is fully up to the standard required for the framework of any kind of admeasurement of detail.

Triangulation and precise traversing, together with spirit and trigonometrical levelling, thus constitute the survey of modern control and the basis of present mapping.